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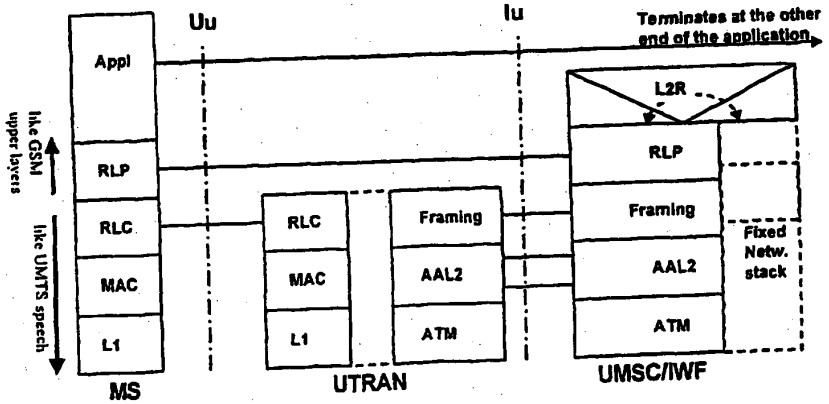
(54) Title: UMTS CIRCUIT SWITCHED DATA USER PLANE



(57) Abstract: The present invention relates to a method which permits circuit switched data communication equipment to be used in an access network like UTMS in an effici nt way. The soluti n is based on the use of the upper layers from GSM together with the transport layers for UTMS speech.

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UMTS CIRCUIT SWITCHED DATA USER PLANE

Technical field

The present invention relates to mobile telecommunication, and in particular use of older circuit switched data communication equipment in the new access networks that are under development.

Technical background

The problem area

GSM and other digital mobile systems have specific solutions for transporting circuit switched data towards the fixed network through their access network.

A new terrestrial radio access network is constructed for the third mobile generation by 3GPP called UMTS. This access network does not have any defined way of handling circuit switched data.

However, there is still a huge amount of circuit switched data communication equipment installed in the fixed network, and people will like to be able to connect via the new access network technology.

Known solutions

Fig 1 shows the network scenario with a mobile terminal communication through UTMS towards circuit switched data communication equipment installed in the PSTN/ISDN. At the present state of the art, circuit switched calls can be supported in the access networks either by a solution using packet data access or speech transport mechanisms.

Packet data access

One of the main intentions of the new mobile system is data access. Optimised IP access (Packet access) has been one of the key drivers when developing the improved air interface solution. A user plane protocol stack ensuring the transmission has been created.

The packet access user plane protocol stack is not very optimised for full duplex links with constant bit rate. It has a lot of overhead that is not needed or beneficial for circuit switched connections. The packet access stack is also optimised for handling burst traffic while it is natural to have more constant payload for mobile circuit switched data access.

The packet access stack could be used also for circuit switched connections, but in addition to the above-mentioned disadvantages it would be tricky to support hand over to GSM circuit switched data calls.

Speech

Speech is also an important service and a solution for ensuring the transport capabilities needed for that, typical low delay and constant bit rate have been specified.

The speech solution has nice transport capabilities for circuit switched calls, but no reliable data transport. The transport have as little delay as possible and are using ATM AAL2 which is optimised for supporting fixed bit rate connections below 64 kbit/s.

If data would be transported in the same way as speech, one would relay on end-to-end fixing of bit errors over the air interface. The protocols supported in fixed network equipment are designed for physical cables, and are not

very efficient when used over the air interface which have a lot of interference and very unstable nature compared with wires.

Summary of the invention

The invention has as its object to provide a method for communication in the new access networks which permits use of older circuit switched communication equipment without the drawbacks associated with the known methods as mentioned above.

In particular the present invention relates to a method for communication in an UTRAN, comprising a mobile terminal working towards a Mobile Switch Centre with an Interworking Function (IWF). According to the said method circuit switched data are transported in the upper layers from GSM which uses the protocols RLP and L2R, on the transport layers for UTMS speech.

The invention also relates to a system for communication between a terminal in a wireless access network and a fixed network which uses said method.

Further embodiments of the invention will appear from the appended patent claims.

Brief description of the drawings

The invention will now be described in detail in reference to the appended drawings in which:

Fig. 1 provides a system overview,

Fig. 2 indicates the main protocols and data transport specifications and where they apply in a system according to the invention

Fig. 3 illustrates the stack according to the present invention using GSM-like upper layer protocols and UMTS speech lower layer protocols.

Description of embodiments

Fig. 1 gives a system overview showing a mobile terminal on the left hand side. UTRAN (UMTS Terrestial Radio Access Network) designates the radio network in which the mobile terminal is communicating trough the Uu interface. UTRAN is the radio part of the UMTS system, while PLMN (Public Land Mobile Network) is the core network behind the UMTS system, i.e. the hardware architecture of switches etc. supporting the UTRAN. The UTRAN is "talking" to the PLMN trough the Iu interface. The UMTS network is connected to the common Public Switched Telephone Network, with its terminals shown on the right hand side.

The basis of this invention is to utilise the upper layers from GSM together with the transport layers for UMTS speech.

In the further discussion reference is made to Fig. 2 which illustrates the main protocols and data transport mechanisms and how they are arranged in a system according to the present invention. The lower layers are utilised by more services, while the upper layers are specific for circuit switched data communication.

The system contains four major parts in the solution, which will be discussed in detail below.

The user equipment

This is the physical equipment that the end user will use to communicate over the radio interface. It can, and probably will, be a lot of very different types of equipment. From physical fax machines connected to UMTS

mobile phones too integrated devices for video transmission. For this solution it is unimportant whether the user equipment contains one or several physical boxes. The user equipment will need to run the RLP over RLC. (See the protocol chapter for further description.)

The UTRAN.

This is, like the abbreviation states, the UMTS terrestrial radio access network. The UTRAN has a lot of functionality for handling the radio access. It takes care of the physical air interface, and also takes care of the hand-overs between different base stations within one UTRAN. One important task of UTRAN related to this invention is the conversion of the actual radio protocols (L1, MAC and RLC) into the Iu protocols (AAL2 and ATM). This conversion is specified for speech, and this invention utilises it. Any speech specific header information added in the Iu framing should be optional and not transported.. Only minor header information is needed containing information like current transport status.

The UMTS MSC.

This node will handle the call control and mobility management for all circuit switched calls. This functionality is of course also needed for circuit switched data calls. The important task of the UMTS MSC for this invention is the interworking functionality, which is called IWF. The IWF does a conversion between the Iu protocols and the protocols towards the fixed network (see figure 1). In GSM this is a conversion of the GSM V.110 and GSM ATRAU protocols on layer 1 and RLP on top for non-transparent calls to ISDN V.110 and modem protocols (LAPM, V.34 etc.) on the fixed network side.

The Server.

At the other end, within the fixed network, is the server. This does not necessarily need to be a server. The term refers to all equipment that you would normally connect to like Access Servers, Corporate servers and local modems. In GSM this could also be another mobile, because the IWF functionality would make this invisible for the user equipment. It is an important aspect of the invention that the server does not notice anything about what is happening within UMTS. This is similar to a GSM circuit switched data call.

The Protocol Stack

Fig. 3 shows a protocol stack that visualises the solution:

This solution utilises the GSM non-transparent protocols RLP and L2R for ensuring no faults in the user data transmitted. The RLP frames uses the GSM 14.4 RLP format because it introduces less overhead.

The solution utilises the UMTS speech protocols (ATM AAL2) for the lower layer unsecured transport.

The user equipment will map the RLP frames to and from the RLC layer.

The function in UTRAN that does a mapping of speech from RLC to the Iu framing over AAL2, needs some small adjustments to transport the circuit switched data in the same way. The adjustment is to handle the Iu framing header also for data calls.

The IWF needs to place the RLP frames into the Iu framing. No rate adaptation is needed for the transport. This is because of the capabilities of AAL2 [I.363.2].

The protocols involved

Reference is again made to Fig. 2 which gives an overview of where the different protocols and specifications apply. We will now give a more detailed discussion of each protocol/layer involved in the inventive method.

Layer 2 RELay (L2R)

Main purpose of L2R is to provide a flow-control mechanism. This is needed to support non-transparent bearer services. The details of the particular L2R function for the different non transparent bearer services are contained in the appropriate GSM 07-series Specification. See ref. .[1], [2] and [3]

The Layer 2 Relay (L2R) function provides for the reliable transportation of known, i.e. non transparent, user protocols across the radio interface of a GSM PLMN. The L2R functions are located in the Mobile Termination (MT) and the Interworking Function (IWF) associated with a Mobile Switching Centre (MSC). The L2R uses the services provided by the Radio Link Protocol (RLP) to transport the non transparent protocol information between the MS and the IWF.

Radio Link Protocol (RLP)

The main purpose of RLP is to provide a secure and error-free data transport between the mobile station and the IWF.

The Radio Link Protocol (RLP) is specified for data transmission over the GSM PLMN. (see ref.[4]) It is based on ideas from other specifications such X.25 and Q.92x (LAP-B and LAP-D of CCITT, respectively.)

It includes several possibilities to invoke retransmissions if the payload is erroneous. RLP has been tailored to the

special needs of digital radio transmission and is intended for use with non-transparent data-transfer.

Radio Link Control Protocol (RLC)

RLC is defined for the radio interface (Uu) in UMTS. Its main purpose is to ensure transfer of user data over this interface. RLC functions are located in the Mobile Station (MS) and the Radio Access Network (UTRAN). It has the following different modes:

- transparent mode
- unacknowledged mode
- acknowledged mode

The modes offer services with different characteristics to the layers above. The transparent mode provides low delay but rather high error rates. The unacknowledged mode is similar to transparent mode but have some additional functions, but it does not include support for retransmissions.

The acknowledge mode, however support retransmissions and provides an error-free service. It has higher delay than the other modes. The actual delay will depend on the radio conditions.

For more details see [5]

Atm Adaptation Layer type 2 (AAL 2)

AAL 2 is a way to transport data on ATM. Compared to other ATM adaptation layers it is most effective for rather small packets. As can be seen from the figure it is goes between UTRAN and the Core Network.

AAL 2 consists of the two parts, the common part and the service specific part.

The common part is specified by recommendation I.363.2 (see ref. [6]). The AAL type 2 provides for the bandwidth-efficient transmission of low-rate, short, and variable length packets in delay sensitive applications. More than one AAL type 2 user information stream can be supported on a single ATM connection.

Recommendation I.366.1 (see ref.[7]), specifies the Segmentation and Reassembly Service Specific Convergence Sublayer of the ATM Adaptation Layer (AAL) type 2. On one or more AAL type 2 user information streams, the Segmentation and Reassemble Service Specific Convergence Sublayer may be deployed. The sublayer structure, and the procedures for the segmentation and reassembly process, as well as the optional transmission error detection and assured data transfer are defined in depth.

Advantages

- Hand over towards 2nd generation GSM can easily be handled since this already is defined at the RLP layer.

- Utilises a lot of existing, proven, functionality. Both the higher layer functionality like compression and flow control and the lower layer functionality like ATM VCs.

- The end user can keep his circuit switched datacom equipment and applications on the server (fixed network) side unmodified.

- The radio network transport capabilities are well suited for circuit switched connections.

Abbreviations

Like most modern areas, the telecom world uses a lot of abbreviations. Here are descriptions for the ones used in this document:

AAL2	ATM Adaptation Layer 2
ATM	Asynchronous Transfer Mode
ETSI	European Telecommunications Standards Institute
GSM	Global System for Mobile communications
IP	Internet Protocol
ISDN	Integrated Services Digital Network
Iu	Interface between UTRAN and Core Network
IWF	Interworking Function (for CS data services)
L1	Layer 1
L2R	Layer 2 relay protocol
MAC	Media Access Control
MSC	Mobile Switching Centre
PLMN	Public Land Mobile Network

PSTN	Public Switched Telephone Network
RAB	Radio Access Bearer
RLC	Radio Link Control
RLP	Radio Link Protocol
UE	User Equipment
UMSC	UMTS Mobile Switching Centre
UMTS	Universal Mobile Telecommunications System
UTRAN	UMTS Terrestrial Radio Access Network
Uu	Interface between UTRAN and the mobile equipment
3GPP	Third generation partnership project created for specifying the third a third generation mobile system. More info available at: http://www.3gpp.org/

References:

[1] General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS) (ETSI GSM 07.01).

[2] Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities (ETSI GSM 07.02).

[3] Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities (ETSI GSM 07.03).

[4] Radio Link Protocol (RLP) for data and telematic services
(ETSI GSM 04.22)

[5] ETSI T.doc SMG2 095/99; UMTS YY.22
Description of RLC,

[6] B-ISDN ATM Adaptation Layer type 2 specification. ITU-T Recommendation I.363.2

[7] Segmentation and reassembly service specific convergence sublayer for the AAL type 2. ITU-T Recommendation I.366.1.

PATENT CLAIMS

1. Method for communication in an UTRAN, comprising a mobile terminal (MS) working towards a Mobile Switch Centre with an interworking function (IWF),
c h a r a c t e r i s e d i n that circuit switched data is transported in upper layers from GSM which uses the protocols RLP and L2R on the transport layers for UTMS speech.

2. Method according to claim 1,
c h a r a c t e r i s e d i n that the RLP transport is performed according to GSM 14.4 format.

3. System for communication between a terminal in a wireless access network and a fixed network,
c h a r a c t e r i s e d i n:

- a mobile terminal which runs a Radio Link Protocol (RLP) over Radio Link Control (RLC)

- an UMTS terrestial radio access network (UTRAN) adapted to convert the actual radio protocols into Iu protocols

- an UMTS Mobile Switching Centre (MSC) comprising an interworking function (IWF) adapted to convert the Iu protocols into the protocols used towards the fixed network

- terminal equipment in the fixed network using GSM upper layer protocols RLP and L2R on standard protocols for UMTS speech for lower layer transport.

4. System as claimed in claim 3,
c h a r a c t e r i s e d i n that the UTRAN is adapted to convert the lower layer L1, MAC and RLC protocols into AAL2 and ATM over Iu.

5. System as claimed in claim 4, characterised in that said IWF is adapted to convert from GSM V.110, GSM ATRAU and RLP to ISDN V.110 and/or modem protocols (LAMPM, V.34) on the fixed network side.

6. System as claimed in claim 5, characterised in that said IWF is adapted to convert from GSM V.110, GSM ATRAU and RLP to ISDN V.110 and/or modem protocols (LAMPM, V.34) on the fixed network side.

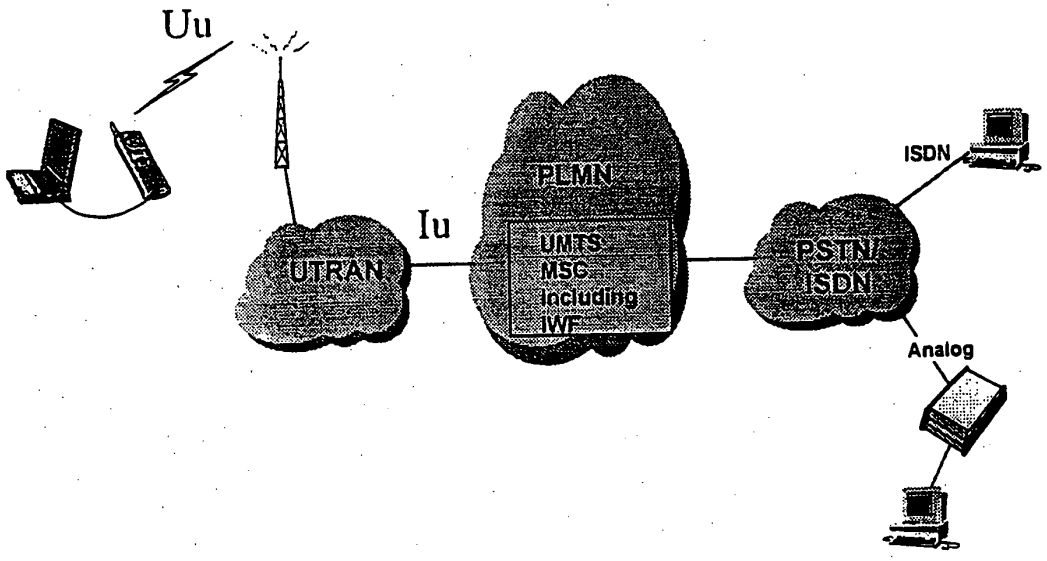
Uu
Iu
UTRAN
PLMN
UMTS
MSC
including
IWF
PSTN/
ISDN
ISDN
Analog

FIGURE 1

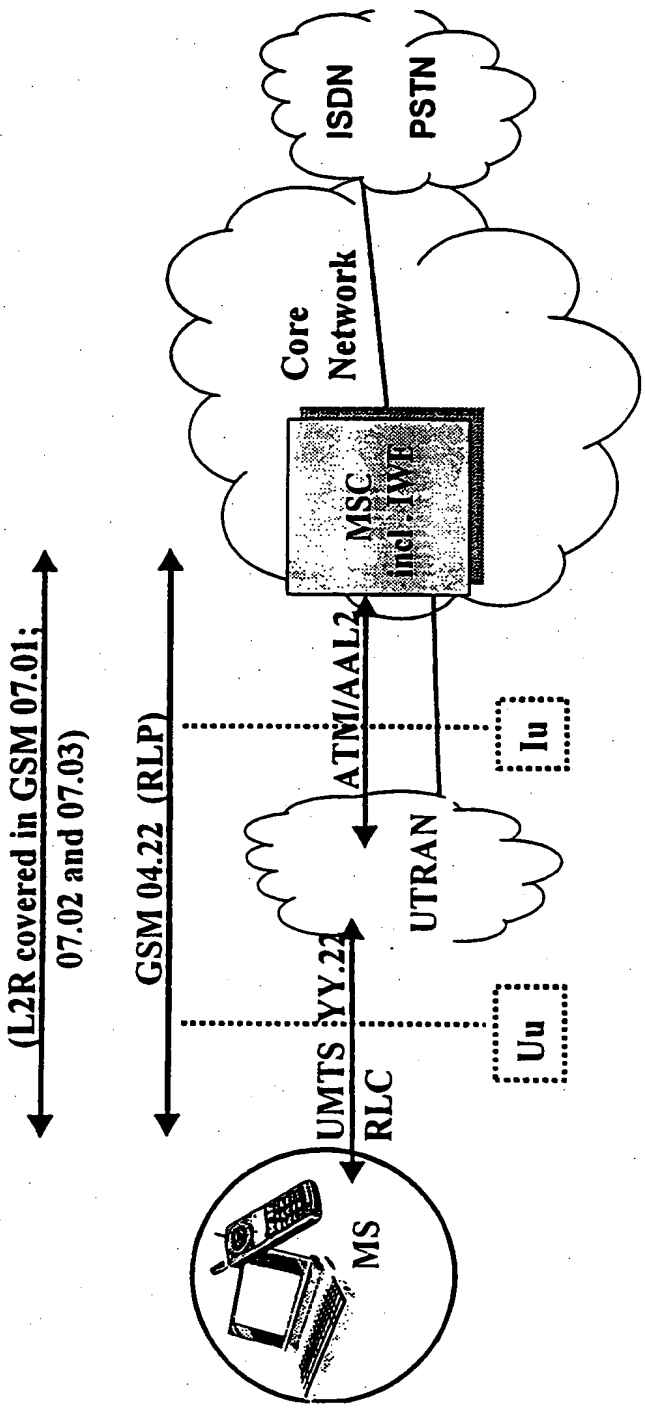
ISDN
PSTN
Core Network
MSC incl. IWF
ATM/AAL2
Iu
UTRAN
YY.22
Uu
UMTS RLC
MS
(L2R covered in GSM 07.01; 07.02 and 07.03)
GSM 04.22 (RLP)

FIGURE 2

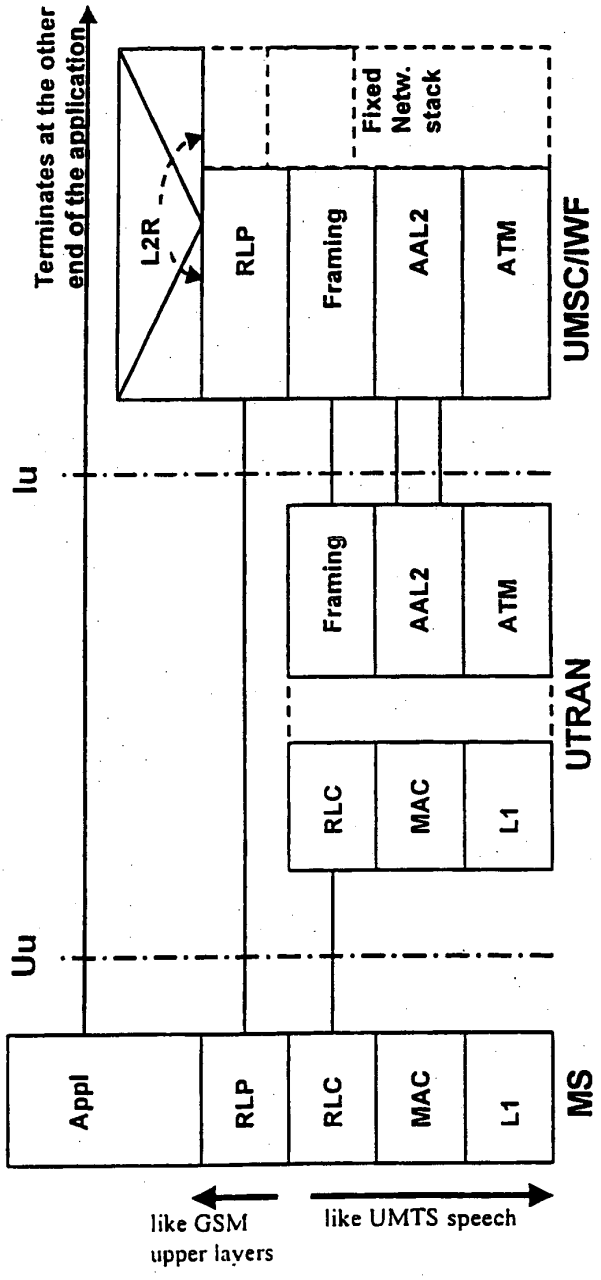
Terminates at the other end of the application
L2R
RLP
Framing
AAL2
ATM
Fixed Netw. stack
UMSC/IWF
Iu
Framing
AAL2
ATM
RLC
MAC
L1
UTRAN
Uu
Appl
RLP
RLC
MAC
L1
MS
like GSM upper layers
like UMTS speech

FIGURE 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01170

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04L 12/50, H04Q 7/22
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04L, H04M, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9837721 A2 (NOKIA TELECOMMUNICATIONS OY), 27 August 1998 (27.08.98), page 8, line 24 - page 17, line 11 --	1-6
A	WO 9920067 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 22 April 1999 (22.04.99), page 8, line 4 - page 12, line 7 --	1-6
A	EP 0789499 A2 (TELIA AB), 13 August 1997 (13.08.97), column 2, line 20 - column 4, line 7 --	1-6

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 August 2000	14 -09- 2000
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INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.
PCT/SE 00/01170

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		FI 980351 A	20/08/98
		ZA 9801325 A	08/09/98
		FI 3694 U	30/10/98
WO 9920067 A1	22/04/99	AU 9468898 A	03/05/99
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EP 0789499 A2	13/08/97	AU 5412096 A	18/11/96
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